WISCONSIN DEPARTMENT OF NATURAL RESOURCES

2023 Boom-Rhinelander Chain Fisheries Survey Report

Waterbody Codes 1580200, 1580300, 1580400, 1580500, 1580100

Photo Credit: Lakeland Aerial

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Introduction

The Boom-Rhinelander Chain of Lakes is an impoundment of the Wisconsin River and Pine Lake Creek within central Oneida County, Wisconsin. The chain was originally created in 1882 to facilitate holding and floating lumber down the Wisconsin River. The five waterbodies that represent the Boom-Rhinelander Chain of Lakes are Bass Lake, Boom Lake, Lake Creek, Rhinelander Flowage and Thunder Lake. The entire Boom-Rhinelander system encompasses 3,576 acres and has ~54.6 miles of shoreline (Andrews and Threien 1966; WVIC). The upstream end of the Rhinelander Flowage is designated as the Bridge Road bridge and the lower end stops at the Rhinelander dam owned and regulated by Expera Specialty Solutions, LLC in Rhinelander. The dam maintains a 10 foot head with canals cut that provide 32 feet of head at the turbines (Kubisiak 2012). Water conditions are fair within the Boom-Rhinelander Chain of Lakes supporting aquatic life, wildlife, recreation, public health and welfare. Chinese mystery snail, curly-leaf pondweed, phragmites, rusty crayfish and yellow iris are invasive species that are established in the Boom-Rhinelander Chain of Lakes. Additional information on the Boom-Rhinelander Chain of Lakes can be found at the Wisconsin Department of Natural Resources' (DNR) Lake Page.

The Boom-Rhinelander Chain of Lakes consists of a complex riverine fishery (Rypel et al. 2019). Fish species throughout the Boom-Rhinelander Chain of Lakes are managed for consumptive opportunities (Kubisiak 2012). Anglers regularly target largemouth bass, muskellunge, and panfish from one of the nine public ramps throughout the Boom-Rhinelander Chain of Lakes (Figure 1). Fishing tournaments, including the Hodag Musky Challenge and the Rhinelander Lions Club Fisheree, bring around 1,500 anglers to the Boom-Rhinelander Chain of Lakes annually. Angling leagues also regularly host events on the Boom-Rhinelander Chain throughout the year (C. Abitz; Wisconsin DNR; Personal Communication).

Fishery monitoring within the Boom-Rhinelander Chain of Lakes has focused on species of recreational value (Table 1). Survey findings have resulted in muskellunge stocking regularly supplementing reproduction (Table 2) and informed regulations changes aimed to maintain sustainable abundances of fishes. The Boom-Rhinelander Chain of Lakes was also included in an adaptive management evaluation testing various panfish regulations in a structured manner on numerous underperforming lakes (Hansen et al. 2015a). The panfish regulation on the Boom-Rhinelander Chain of Lakes was changed from the statewide standard of no minimum length limit with an aggregate 25 per day creel limit to a no minimum length limit with a 15 per day creel limit but no more than 5 of any one species during May and June but 25 panfish in total the rest of the year in 2016.

The objectives of the 2023 fishery survey on the Boom- Rhinelander Chain of Lakes survey were to

1. assess the status of the fish community
2. evaluate effects of the panfish regulation change
3. quantify the amount of walleye and muskellunge reproduction

Table 1. Fish surveys from 1957-2023 on the Rhinelander Chain of Lakes Oneida County, Wisconsin.

YEAR	WATERBODY	TYPE	GEAR	TARGET SPECIES	SURVEY PURPOSE
1957	Boom	SN 1	fyke net	walleye	relative abundance
	Rhinelander Flowage	FN	fyke net	all species	relative abundance
1962	Boom	FE	boom shocker	all species	relative abundance
2005	Boom	FE	boom shocker	all species	relative abundance
	Boom	FN	mini fyke net	all species	recruitment monitoring
	Rhinelander Flowage	FE	boom shocker	all species	relative abundance
	Rhinelander Flowage	FN	mini fyke net	all species	recruitment monitoring
	Thunder	FE	boom shocker	all species	relative abundance
	Thunder	FN	boom shocker	all species	recruitment monitoring
2011	Bass	SN 2	fyke net	gamefish	population estimate
	Bass	FE	boom shocker	walleye	recruitment monitoring
	Boom	SN 1 & 2	fyke net	gamefish	population estimate
	Boom	FE	boom shocker	gamefish	recruitment monitoring
	Boom	FN	fyke net	panfish	relative abundance
	Lake Creek	SN 1 & 2	fyke net	gamefish	population estimate
	Rhinelander Flowage	SN 1 & 2	fyke net	gamefish	population estimate
	Rhinelander Flowage	FE	boom shocker	walleye	recruitment monitoring
	Thunder	SN 1 & 2	fyke net	gamefish	population estimate
	Thunder	FE	boom shocker	gamefish	recruitment monitoring
2015	Boom	SN 3	fyke net	black crappie	relative abundance
	Rhinelander Flowage	SN 3	fyke net	black crappie	relative abundance
2021	Boom	SN 3	fyke net	all species	relative abundance
2023	Bass	SN 3	fyke net	panfish	relative abundance
	Boom	SE 2	boom shocker	all species	relative abundance
	Boom	SN 3	fyke net	panfish	relative abundance
	Boom	FE	fyke net	gamefish	recruitment monitoring
	Lake Creek	SN 3	fyke net	panfish	relative abundance
	Rhinelander Flowage	SN 3	fyke net	panfish	relative abundance
	Rhinelander Flowage	FE	fyke net	gamefish	recruitment monitoring
	Thunder	SE 2	boom shocker	all species	relative abundance
	Thunder	SN 3	fyke net	panfish	relative abundance

Table 2. Fish stockings from 1973-2023 on the Rhinelander Chain of Lakes, Oneida County, Wisconsin.

YEAR	WATERBODY	SPECIES	AGE CLASS	NUMBER OF FISH STOCKED	SOURCE TYPE
1973	Lake Creek	muskellunge	fingerling	316	DNR
	Rhinelander Flowage	muskellunge	fingerling	1,000	DNR
1974	Rhinelander Flowage	muskellunge	fingerling	1,100	DNR
1975	Thunder	muskellunge	fingerling	357	DNR
1976	Rhinelander Flowage	muskellunge	fingerling	515	DNR
1979	Rhinelander Flowage	muskellunge	fingerling	800	DNR
	Thunder	walleye	fry	2,000,000	DNR
1981	Rhinelander Flowage	muskellunge	fingerling	250	DNR
1982	Rhinelander Flowage	muskellunge	fingerling	3,059	DNR
1984	Rhinelander Flowage	muskellunge	fingerling	1,505	DNR
1985	Rhinelander Flowage	muskellunge	fingerling	3,300	DNR
1987	Rhinelander Flowage	muskellunge	fingerling	2,403	DNR
1989	Rhinelander Flowage	muskellunge	fingerling	400	DNR
1990	Rhinelander Flowage	channel catfish	fingerling	6,328	DNR
	Rhinelander Flowage	muskellunge	fingerling	3,000	DNR
1991	Boom	muskellunge	fingerling	400	DNR
	Rhinelander Flowage	muskellunge	fingerling	910	DNR
1992	Boom	muskellunge	fingerling	400	DNR
	Rhinelander Flowage	muskellunge	fingerling	1,300	DNR
1993	Boom	muskellunge	fingerling	400	DNR
	Rhinelander Flowage	muskellunge	fingerling	2,500	DNR
1995	Boom	muskellunge	fry	100,000	DNR
1996	Boom	muskellunge	fingerling	934	DNR
	Boom	muskellunge	fry	100,000	DNR
	Rhinelander Flowage	muskellunge	fingerling	10,000	DNR
	Rhinelander Flowage	muskellunge	fry	109,770	DNR
1997	Rhinelander Flowage	muskellunge	large fingerling	1,250	DNR
1998	Boom	muskellunge	large fingerling	870	DNR
1999	Rhinelander Flowage	muskellunge	large fingerling	1,000	DNR
2000	Boom	muskellunge	large fingerling	870	DNR
2012	Bass	muskellunge	large fingerling	31	DNR
	Boom	muskellunge	large fingerling	110	DNR
	Lake Creek	muskellunge	large fingerling	43	DNR
	Rhinelander Flowage	muskellunge	large fingerling	332	DNR
	Thunder	muskellunge	large fingerling	43	DNR
2014	Bass	muskellunge	large fingerling	32	DNR
	Boom	muskellunge	large fingerling	110	DNR
	Lake Creek	muskellunge	large fingerling	44	DNR
	Rhinelander Flowage	muskellunge	large fingerling	332	DNR
	Thunder	muskellunge	large fingerling	44	DNR
2016	Bass	muskellunge	large fingerling	31	DNR
	Boom	muskellunge	large fingerling	108	DNR
	Lake Creek	muskellunge	large fingerling	43	DNR
	Rhinelander Flowage	muskellunge	large fingerling	332	DNR
	Thunder	muskellunge	large fingerling	43	DNR
2018	Bass	muskellunge	large fingerling	28	DNR
	Boom	muskellunge	large fingerling	99	DNR
	Lake Creek	muskellunge	large fingerling	39	DNR
	Rhinelander Flowage	muskellunge	large fingerling	300	DNR
	Thunder	muskellunge	large fingerling	39	DNR
2022	Bass	muskellunge	large fingerling	46	DNR
	Boom	muskellunge	large fingerling	91	DNR
	Lake Creek	muskellunge	large fingerling	47	DNR
	Rhinelander Flowage	muskellunge	large fingerling	342	DNR
	Thunder	muskellunge	large fingerling	46	DNR

YEAR	WATERBODY	SPECIES	AGE CLASS	NUMBER OF FISH STOCKED	SOURCE TYPE
2023	Bass	muskellunge	large fingerling	31	DNR
	Boom	muskellunge	large fingerling	110	DNR
	Lake Creek	muskellunge	large fingerling	43	DNR
	Rhinelander Flowage	muskellunge	large fingerling	331	DNR
	Thunder	muskellunge	large fingerling	43	DNR

Methods

A fishery survey focused on bass and panfish was conducted on the Boom-Rhinelander Chain of Lakes during 2023. Late spring electrofishing for bass and panfish (SE2), late spring netting (SN3) and fall electrofishing for juvenile gamefish (FE) occurred across the Boom-Rhinelander Chain of Lakes (Figure 2). Sampling provided a description of the status of the bass and panfish fishery, size structure of select species, relative abundance of panfish species, growth rates of black crappies and bluegills and the amount of walleye and muskellunge reproduction.

SURVEY EFFORT

Spring fyke netting was conducted across the Boom-Rhinelander Chain of Lakes in 2023 using standard 4-foot framed fyke nets. Four nets were set on May 19 and fished until May 22, 2023 in Boom Lake. Two nets were set on May 19 and fished until May 22, 2023 in Bass Lake, Lake Creek and Thunder Lake. Six nets were set on May 21 and fished until May 23, 2023 in the Rhinelander Flowage. Nets were set in varying habitats (i.e., substrate and vegetation) and water depths targeting spawning adult fish. Nets were checked once every 24 hours.

Late spring electrofishing was conducted on Boom Lake on June 5, 2023 and Thunder Lake on June 1, 2023. Boats sampling during SE 2 runs used AC power, two probes (each with 3 droppers), and two dippers with nets having 0.375-inch bar mesh netting. Two half-mile transects targeting all species were randomly selected and two 1.5-mile transects targeting gamefish stations were randomly selected in each lake.

Fall electrofishing using AC boom shocker boat was conducted on the night of Oct. 2, 2023 in Boom Lake and Oct. 11, 2023 in the Rhinelander Flowage. One boat sampled the entire shoreline of Boom Lake (~6.0 miles). Two boats sampled 12.6 shoreline miles of the Rhinelander Flowage. Two dippers using nets with 0.375-inch bar mesh netting targeted juvenile fish on each boat during each survey.

Captured gamefish and panfish during all sampling were measured to the nearest 0.1 inch. Muskellunge were checked for a PIT (passive integrated transponder) tag and if one was not found, a PIT tag was placed internally adjacent to the dorsal fin and released. Otoliths were collected from ten bluegills within the 5-inch (e.g., 5.0-5.9 inches) and 7+inch (e.g., >7.0 inches) length bin and from ten black crappie within the 7-inch (7.0-7.9 inches) and 9.0+ inch (e.g., >9.0 inches) length bins within Bass Lake, Boom Lake and the Rhinelander Flowage for age and growth estimation (Simonson et al. 2013). Counts were recorded for all other species.

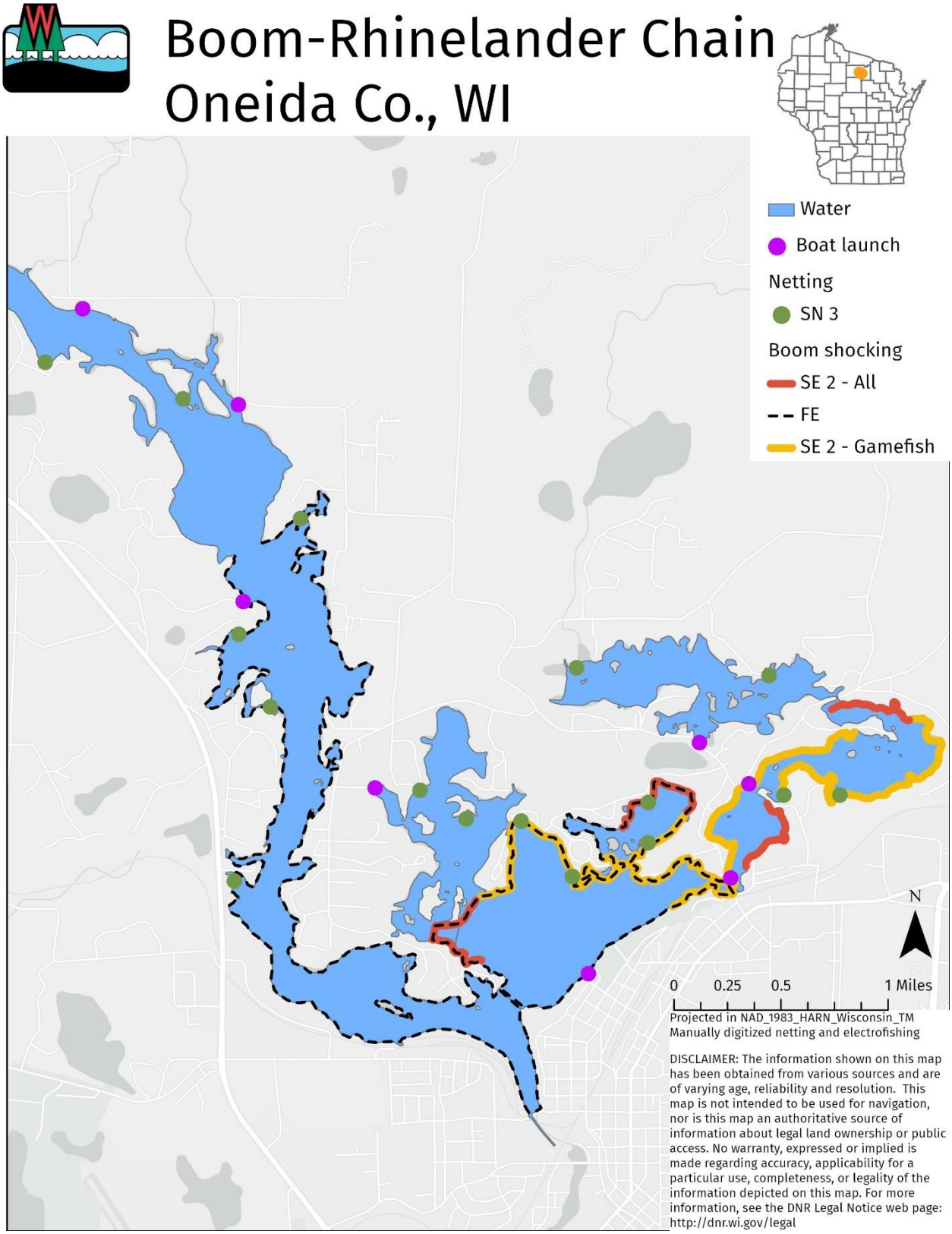

Figure 1. Sampling locations with capture gears used during the 2023 survey of the Boom-Rhinelander Chain of Lakes in Oneida County, Wisconsin.

DATA ANALYSIS

Relative abundance was used as an index of population size for fish within the Boom-Rhinelander Chain of Lakes. Bluegill, pumpkinseed and rock bass relative abundance was indexed as the number of individuals per shoreline mile during SE 2 runs collecting all fish. Largemouth bass, northern pike, smallmouth bass and walleye relative abundance was indexed as the number of individuals per shoreline mile during SE 2 runs collecting all fish or gamefish. Black crappie and yellow perch relative abundance were indexed as the number of individuals per net night during SN 3 surveys.

Size structure of fishes were described using length frequencies, descriptive statistics and proportional size distribution (PSD; Gabelhouse 1984). Quality-sized fish are 36% of the world-record length and preferred-sized fish are 45% of the world-record length representing fish lengths anglers likely enjoy catching (Table 3). The PSD value for a species was calculated as the number of fish of a quality length and longer divided by the number of stock length fish or longer and multiplied by 100. The mean, minimum and maximum length of each fish species was calculated before and after the panfish regulation chain on the Boom-Rhinelander Chain of Lakes to assess impacts of the regulation change.

Table 3. Proportional size distribution lengths of select fish species in the Boom-Rhinelander Chain of Lakes, Oneida County, WI.

SPECIES	STOCK SIZE (IN)	QUALITY SIZE (IN)	PREFERED SIZE (IN)
black crappie	5	8	10
bluegill	3	6	8
largemouth bass	8	12	15
muskellunge	20	30	38
northern pike	14	21	28
pumpkinseed	3	6	8
rock bass	4	7	9
smallmouth bass	7	11	14
walleye	10	15	20
yellow perch	5	8	10

Growth was quantified by assigning ages to collected aging structures. Mean age at 5 inches and > 7 inches was calculated for bluegill and mean age at 7 inches and >9 inches for black crappies. Mean ages at specific lengths were compared to the statewide average (2005-2023).

Fall electrofishing provided an index of reproduction. Age-0 walleye density was calculated following Hansen et al. (2004) updated from Serns (1982) of

$$Denisty = 0.0345 * (Age0\ catch\ per\ mile)^{1.564}$$

Age-1 walleye density was calculated following Shaw and Sass (2020)

$$Denisty = 0.1426 * Age\ 1\ catch\ per\ mile + 1.3347$$

Results

BLACK CRAPPIE

A total of 1,000 black crappie (2 electrofishing, 998 netting) were captured while surveying the Boom-Rhinelander Chain of Lakes. Overall black crappie catch rate was 29.4 black crappie per net night during netting and 1.0 black crappie per mile during electrofishing throughout the chain. Black crappie catch rate varied across the chain between 8.0 individuals per net night in Lake Creek and 55.8 individuals per net night in Boom Lake. Black crappie fyke net catch rate was in the 90th percentile for complex riverine systems. Black crappie catch rate increased in Boom Lake since the panfish regulation change and decreased in Rhinelander Flowage (Figure 2; top left pane).

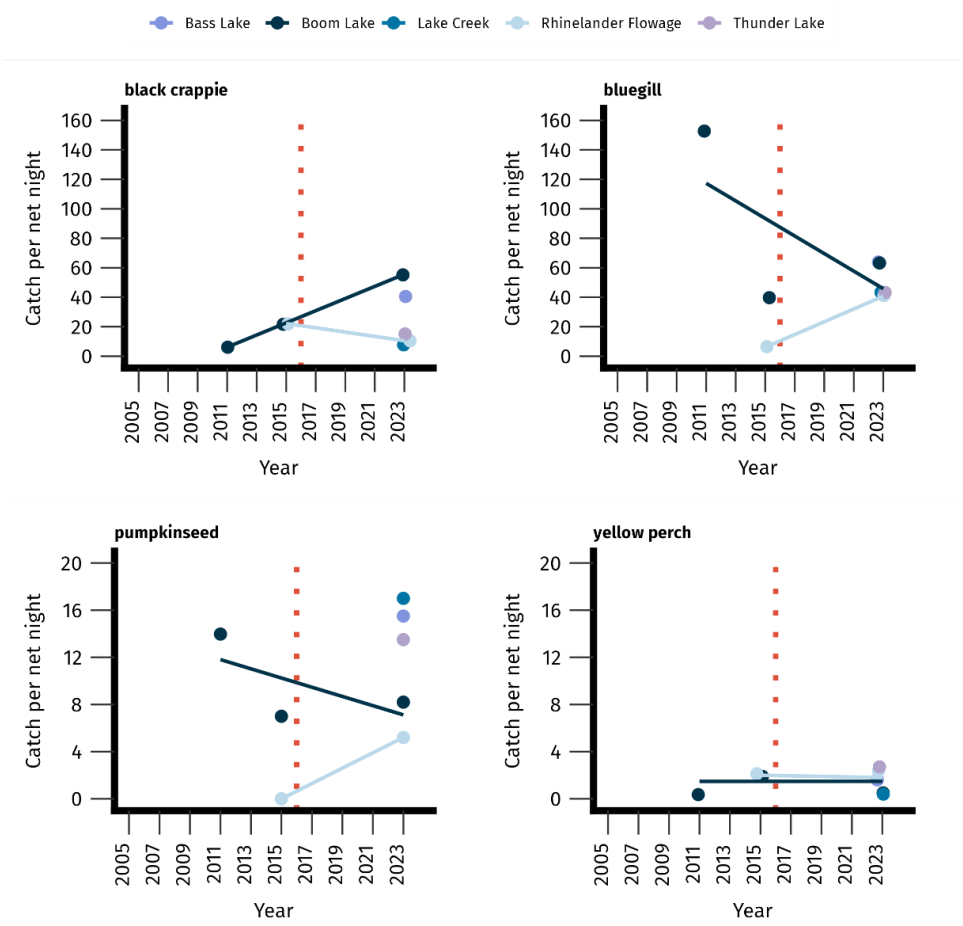

Figure 2. Catch rate of select panfish during fyke net surveys across the Boom-Rhinelander Chain of Lakes. Points within the same year among lakes were jittered to remove overlap. Dotted vertical red line denotes when the no minimum length limit with an aggregate 25 per day creel limit changed to a no minimum length limit with a 15-creel limit but no more than 5 of any one species during May and June but 25 panfish in total the rest of the year in 2016.

Lengths of measured black crappie varied between 1.0 to 13.9 inches (Figure 3). Mean length of measured black crappie varied across the chain between 8.8 inches in Bass Lake and 9.0 inches in Lake Creek. Mean length of black crappie was in the 95th percentile for complex riverine systems. Proportional size distribution of black crappie increased slightly since the regulation change in 2016 (Figure 4). Mean length of measured black crappie has increased through time with an increase of 1.7 inches with electrofishing and 1.8 inches with fyke nets since 2005 (Figure 5).

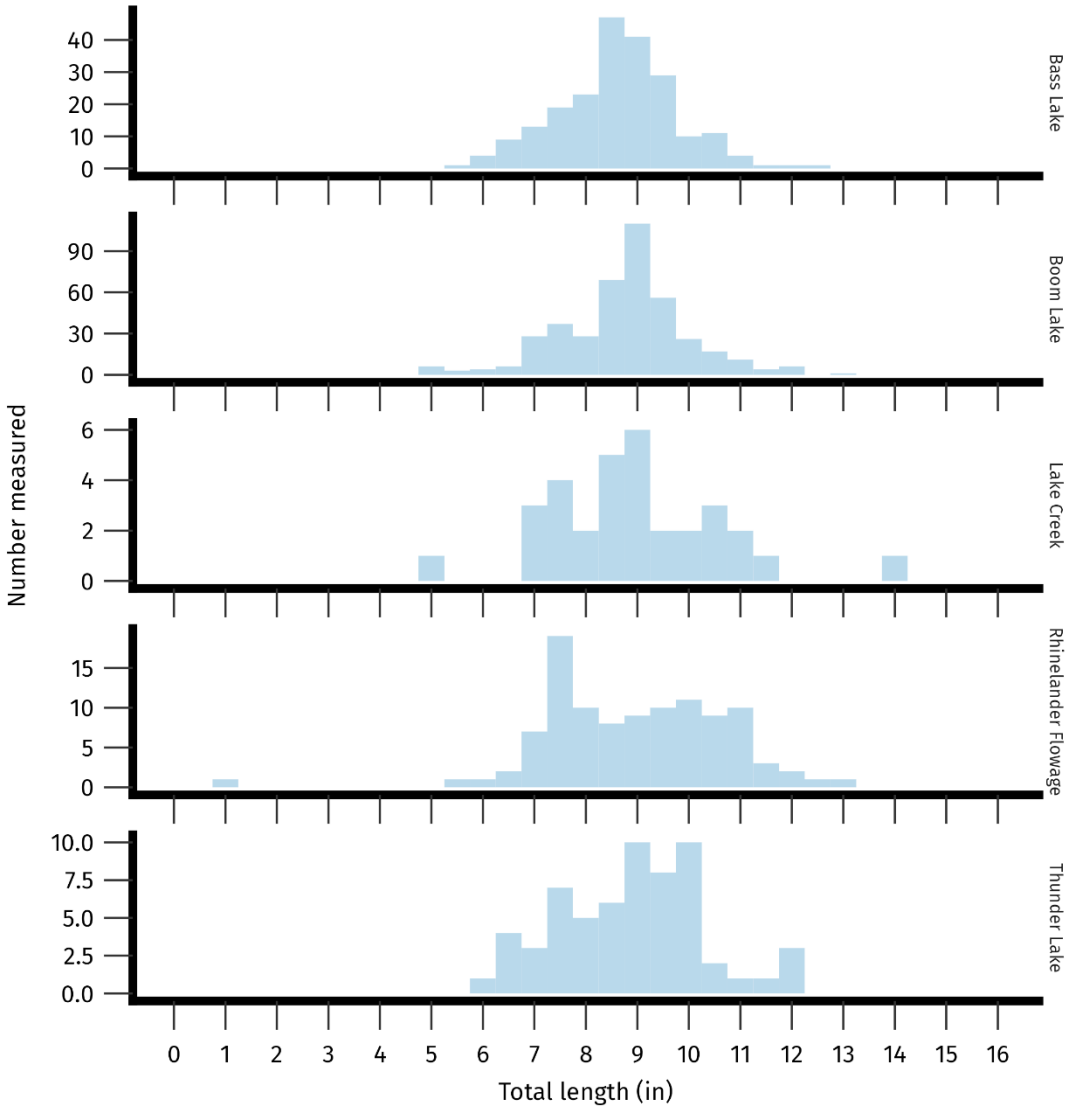

Figure 3. Length frequency of measured black crappie within each lake of the Boom-Rhinelander Chain of Lakes, Oneida County, WI during the 2023 survey. Length bins are every 0.5 inch.

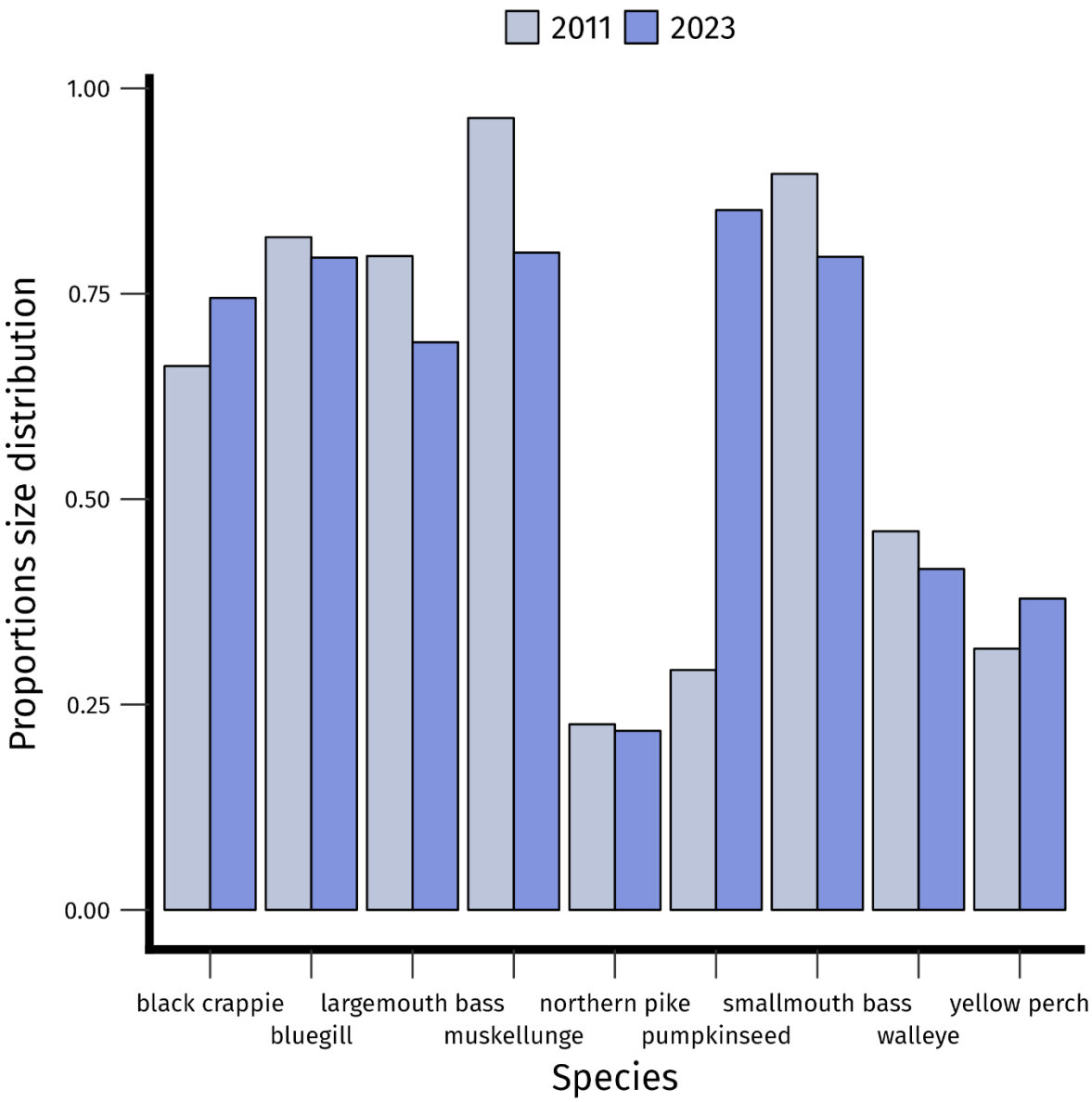

Figure 4. Proportional size distribution of quality length fish from select species captured within each lake of the Boom-Rhinelander Chain of Lakes, Oneida County, WI during the 2023 survey.

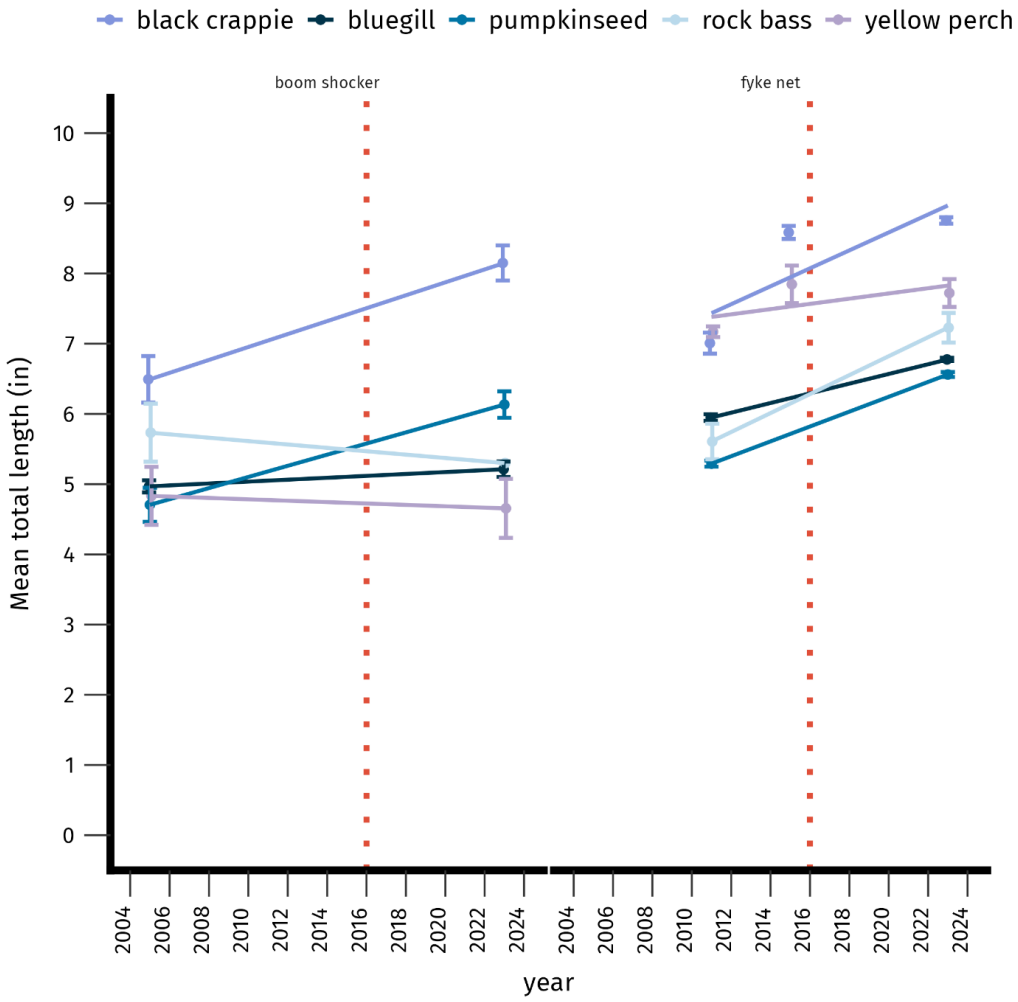

Figure 5. Mean total length (±1 SE) of measured fish captured during electrofishing (left) and fyke netting (right) in the Boom-Rhinelander Chain of Lakes. Each species has a unique colored line. Dotted vertical red line denotes when the no minimum length limit with an aggregate 25 per day creel limit changed to a no minimum length limit with a 15-creel limit but no more than 5 of any one species during May and June but 25 panfish in total the rest of the year in 2016.

Otoliths were collected from 48 black crappies throughout the Boom-Rhinelander Chain of Lakes. Assigned black crappie ages varied between 3.0 years old to 8.0 years old. Growth was quicker to 9 inches in the Rhinelander Flowage compared to Bass Lake and Boom Lake but similar to 7 inches among lakes (Figure 6). Mean age of black crappie at 7 inches across the Boom-Rhinelander Chain of Lakes was 3.0 years old which is younger than the statewide average of 4.0 years old to that length (Figure 6). Mean age of black crappie at 9 inches was 6.3 years old which was slightly older than the statewide of 5.7 years old to that length (Figure 6).

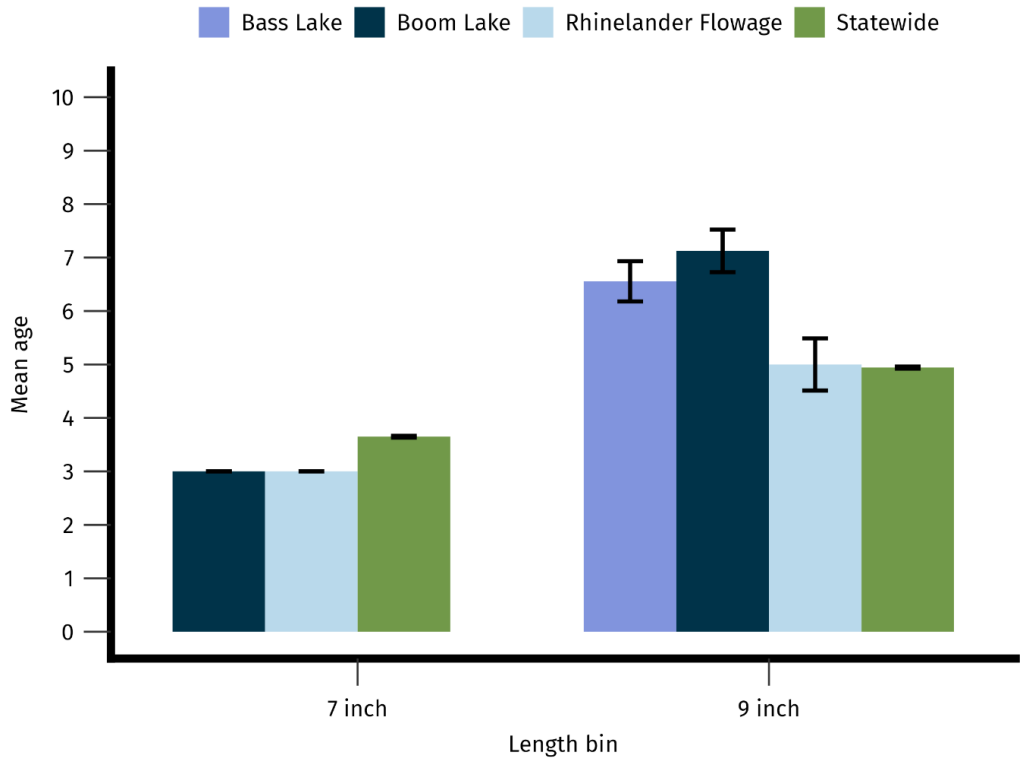

Figure 6. Mean age (±1 standard deviation) of black crappie within the 7-inch and 9-inch length bin in which otoliths were collected from the Boom-Rhinelander Chain of Lakes during the spring of 2023 survey. Each lake within the Boom-Rhinelander Chain of Lakes is a unique color with the statewide average included for comparison. No crappie were collected in the 7-inch length bin on Bass Lake.

BLUEGILL

A total of 1,920 bluegill (152 electrofishing, 1,768 netting) were captured while surveying the Boom-Rhinelander Chain of Lakes. Overall catch rate for bluegill was 52.0 individuals per net night during netting and 76.0 individuals per mile during electrofishing. Bluegill catch rate varied across the chain between 40.7 individuals per net night in the Rhinelander flowage and 63.7 individuals per net night in Bass Lake. Bluegill catch per mile across the chain was within the 44th percentile statewide and above the 50th percentile for complex riverine systems. Bluegill catch rate has increased in Boom Lake and the Rhinelander Flowage since the panfish regulation change (Figure 2; top right pane).

Lengths of measured bluegills varied between 1.8 to 9.8 inches (Figure 7). Mean length of captured bluegills varied throughout the Boom-Rhinelander Chain of Lakes between 5.9 inches in Thunder Lake and 7.6 inches in the Rhinelander Flowage. Mean length of bluegill was above the 95th percentile for complex riverine systems. Proportional size distribution of bluegill decreased slightly since the regulation change in 2016 (Figure 3). Mean length of measured bluegills has increased through time with an 0.2-inch increase with electrofishing and 0.8-inch increase with fyke nets (Figure 5).

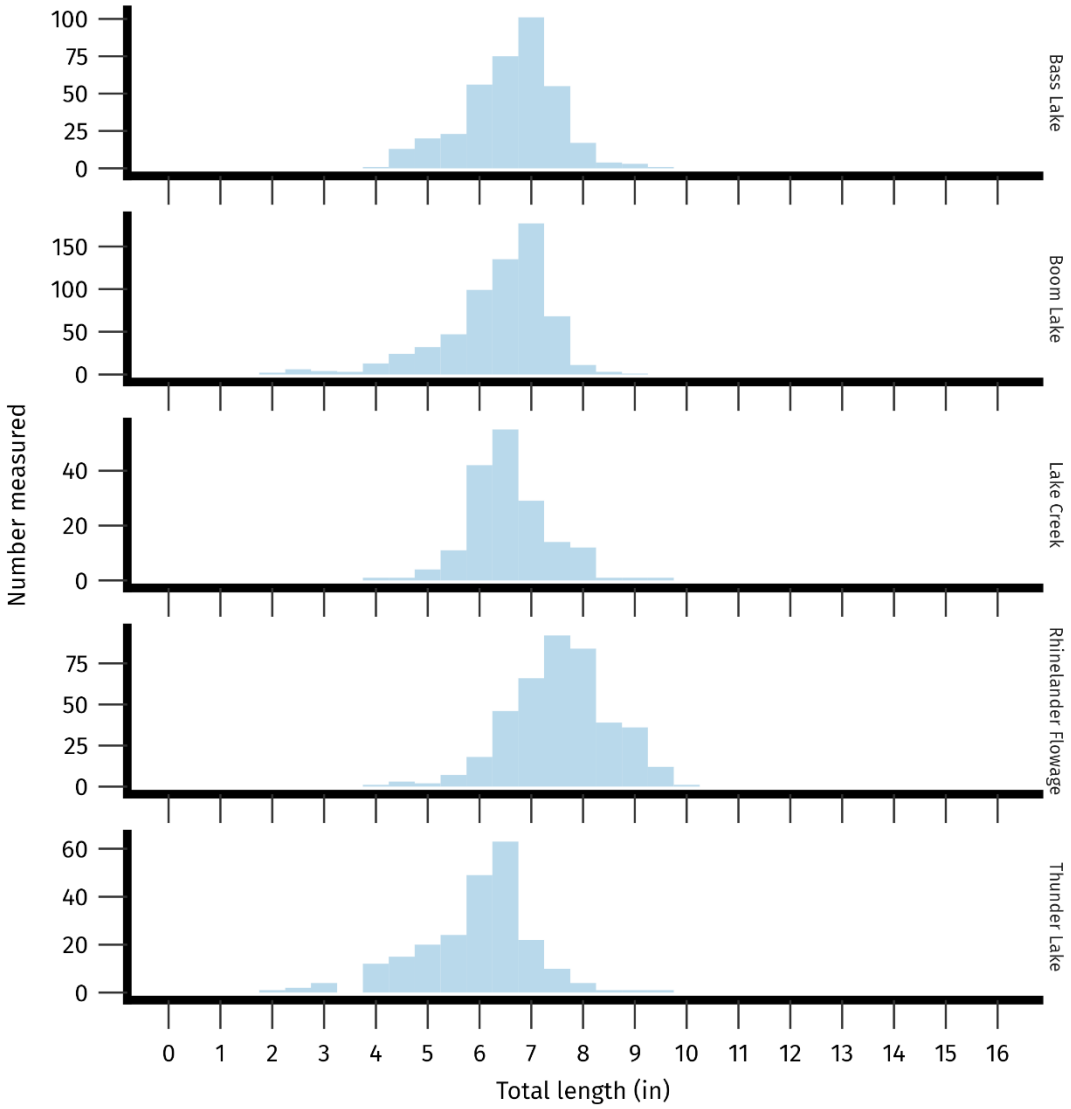

Figure 7. Length frequency of measured bluegill within each lake of the Boom-Rhinelander Chain of Lakes, Oneida County, WI during the 2023 survey. Length bins are every 0.5 inch.

Otoliths were collected from 73 bluegills across the Boom-Rhinelander Chain of Lakes. Assigned bluegill ages varied between 3.0 years old to 12.0 years old. Growth to 5 inches and 7 inches was quicker in the Rhinelander Flowage compared to Bass Lake and Boom Lake (Figure 8). Mean age of 5-inch bluegill across the Boom-Rhinelander Chain of Lakes was 4.7 years old which is similar to the statewide average of 4.2 years old (Figure 8). Mean age of 7-inch bluegill was 7.9 years old which is older than statewide average of 5.8 years old (Figure 8).

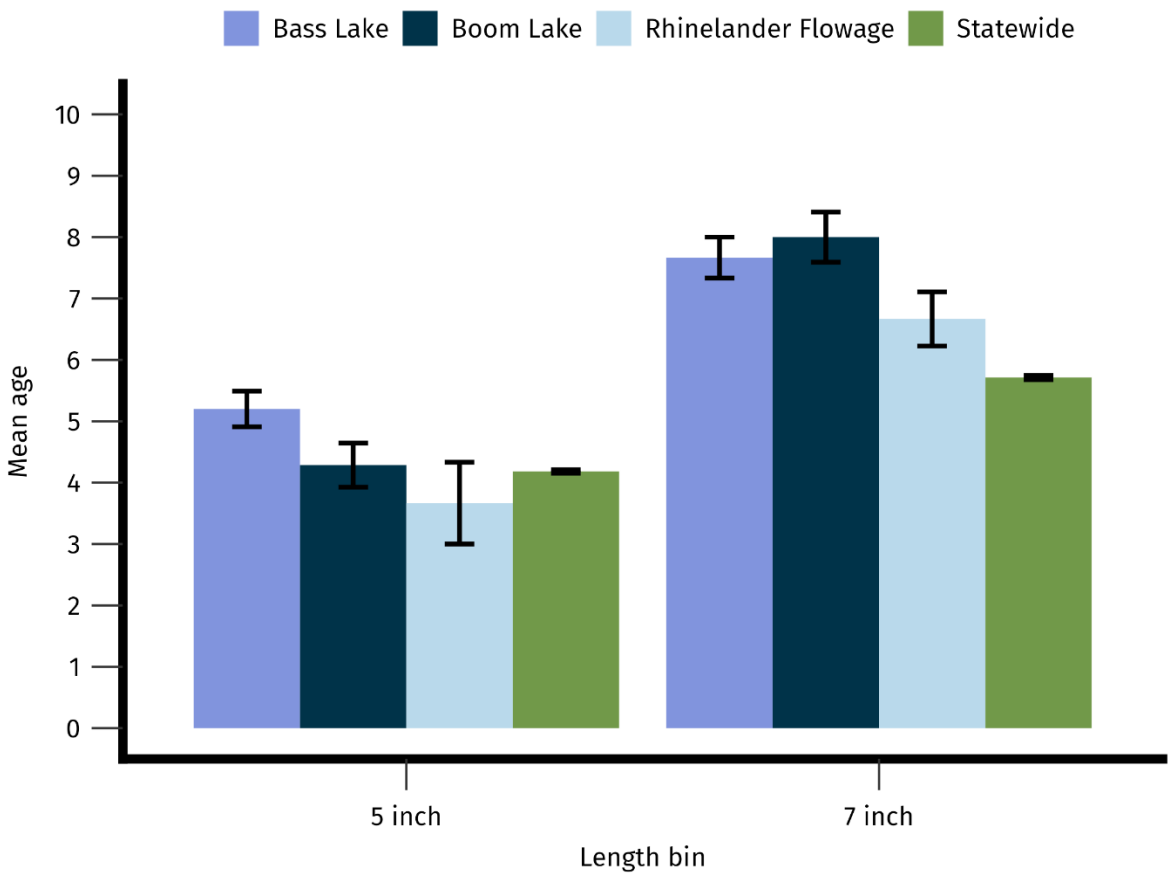

Figure 8. Mean age (±1 standard deviation) of bluegill within the 5-inch and 7-inch length bin in which otoliths were collected from the Boom-Rhinelander Chain of Lakes during the spring of 2023 survey. Each lake within the Boom-Rhinelander Chain of Lakes is a unique color with the statewide average included for comparison.

LARGEMOUTH BASS

A total of 126 largemouth bass (93 electrofishing, 33 netting) were captured while surveying Boom-Rhinelander Chain of Lakes. Overall catch rate for largemouth bass was 3.5 individuals per mile during electrofishing and 1.0 individuals per net night during netting. Catch per mile of largemouth bass across the chain was in the 38th percentile statewide and the 50th percentile for complex riverine systems. Largemouth bass catch rate varied across the chain between 5.9 per mile in Thunder Lake and 1.5 per mile in the Rhinelander Flowage.

Measured largemouth bass lengths varied between 2.2 inches to 19.6 inches with a mean length of 11.2 inches (Figure 9). Mean largemouth bass length was in the 95th percentile for complex riverine systems. Mean length of captured largemouth bass varied across the chain between 8.5 inches in the Rhinelander Flowage to 15.0 inches in Lake Creek. Proportional size distribution of largemouth bass decreased slightly since the regulation change in 2016 (Figure 4).

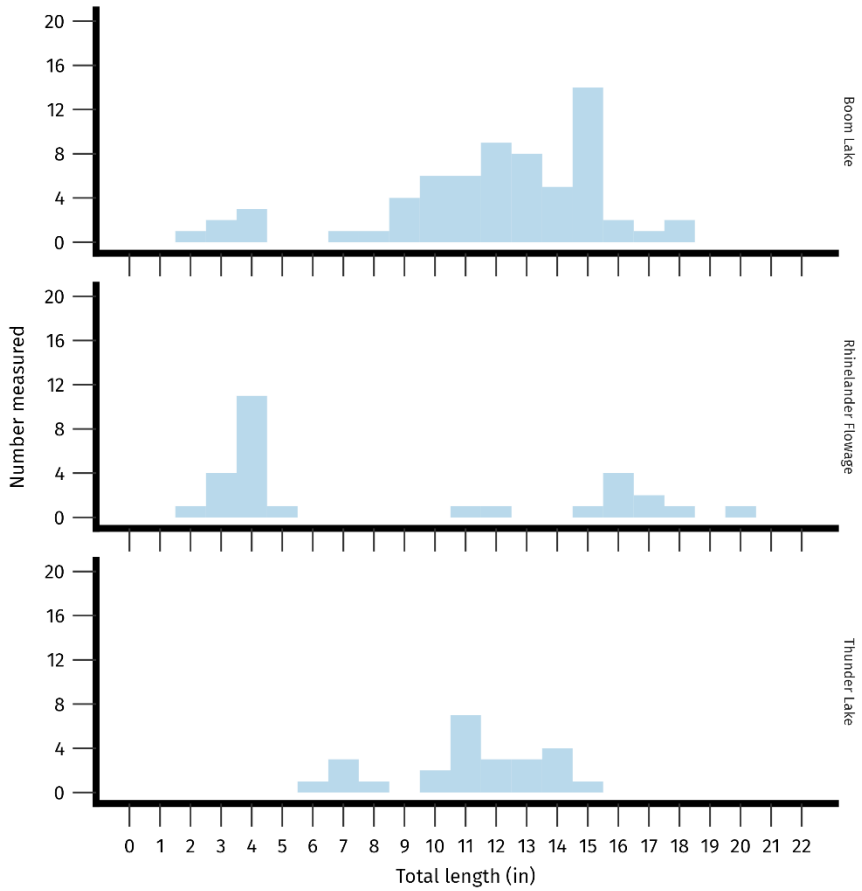

Figure 9. Length frequency of measured largemouth bass across the Boom-Rhinelander Chain of Lakes, Oneida County, WI during the 2023 survey. Length bins are every 1.0 inch. Bass Lake and Lake Creek were dropped from the figure as no largemouth were captured there.

MUSKELLUNGE

A total of 21 muskellunge (15 electrofishing, 6 netting) were captured while surveying Boom-Rhinelander Chain of Lakes despite not being the target of surveys. Overall muskellunge catch rate was 0.2 individuals per net night during netting and 0.6 individuals per mile during electrofishing. Catch per net night of muskellunge was in the 20th percentile statewide and in the 1st percentile for complex riverine systems despite not being the primary target. Muskellunge catch rate during netting varied across the chain between 0.0 individuals per net night in Lake Creek to 0.3 individuals per net night in Boom Lake. Muskellunge catch rate during electrofishing varied across the chain between 0.2 individuals per mile in Thunder Lake to 0.9 individuals per mile in the Rhinelander Flowage.

Lengths of muskellunge varied between 7.7 inches to 41.7 inches with a mean length of 18.4 inches (Figure 10). Mean length of captured muskellunge varied across the chain between 21.2 inches in Boom Lake to 35.7 inches in Bass Lake. Forty percent of measured muskellunge were 38 inches or greater. Proportional size distribution of muskellunge decreased slightly since 2016 (Figure 4).

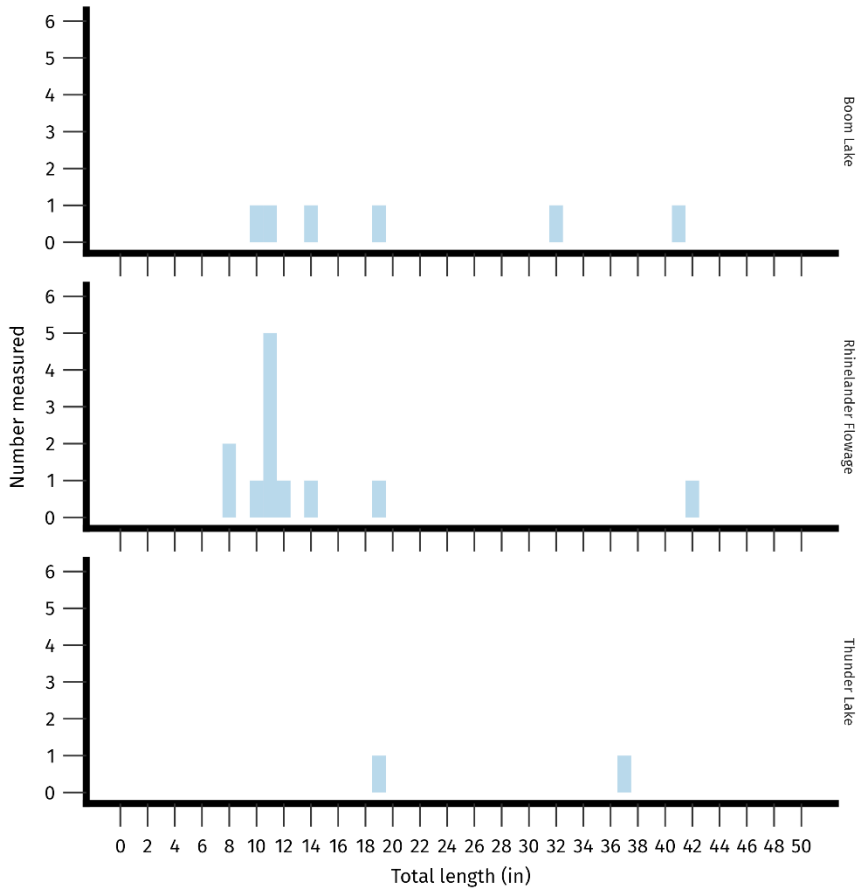

Figure 10. Length frequency of measured muskellunge across the Boom-Rhinelander Chain of Lakes, Oneida County, WI during the 2023 survey. Lengths bins are every 2.0 inches. Bass Lake and Lake Creek were dropped from the figure as no muskellunge were captured there. Caution should be applied when interpreting size structure as few individuals were captured.

Fourteen muskellunge suspected to be age-0 or age-1 (<20 inches in the fall) were captured across the Boom-Rhinelander Chain of Lakes. Catch rate of suspected age-0 and age-1 muskellunge was 0.8 individuals per mile. Suspected age-0 and age-1 muskellunge varied in size from 7.5 inches to 18.7. Average length of the 518 muskellunge stocked on September 19th was 11.1 inches prior to the fall electrofishing but individuals as small as 7.7 inches were captured in the fall.

NORTHERN PIKE

A total of 125 northern pike (78 electrofishing, 47 netting) were captured while surveying the Boom-Rhinelander Chain of Lakes. Northern pike catch rate was 1.3 individuals per net night during netting and 2.9 individuals per mile during electrofishing. Catch per net night of northern pike was slightly below the 50th percentile for complex riverine systems. Northern pike catch rate during netting varied across the chain between 0.0 individuals per net night in Bass Lake to 1.7 individuals per net night in the Rhinelander Flowage. Northern pike catch rate during

electrofishing varied across the chain between 0.0 individuals per mile in Lake Creek to 4.1 individuals per mile in the Rhinelander Flowage.

Lengths of northern pike varied between 5.8 inches to 32.9 inches with a mean length of 16.8 inches (Figure 11). Mean length of captured northern pike varied across the chain between 15.7 inches in the Rhinelander Flowage to 26.2 inches in Lake Creek. Twenty one percent of measured northern pike were 21 inches or greater. Mean northern pike length was in the 60th percentile for complex riverine systems. Northern pike proportional size distribution has remained relatively stable since the regulation change in 2016 (Figure 4).

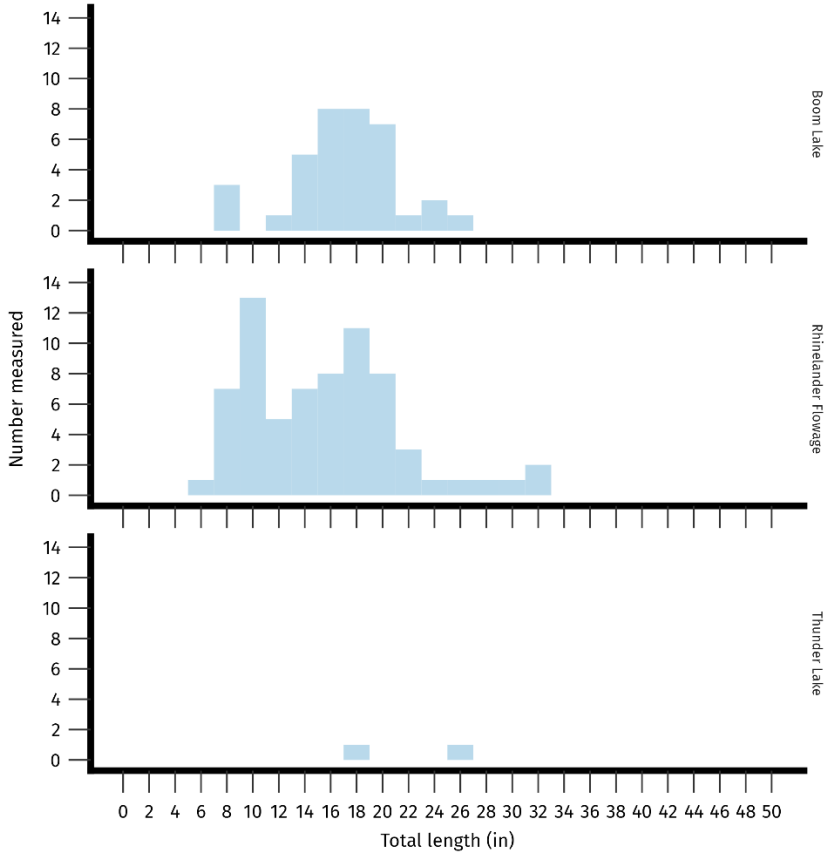

Figure 11. Length frequency of measured northern pike across the Boom-Rhinelander Chain of Lakes, Oneida County, WI during the 2023 survey. Length bins are every 2.0 inches. Bass Lake and Lake Creek were dropped from the figure as no northern pike were captured there.

PUMPKINSEED

A total of 364 pumpkinseed (15 electrofishing, 349 netting) were captured while surveying Boom-Rhinelander Chain of Lakes. Pumpkinseed catch rate was 10.3 individuals per net night during netting and 7.5 individuals per mile during electrofishing. Pumpkinseed catch rate varied across the chain between 5.2 individuals per net night in the Rhinelander flowage to 17.0 individuals per net night in Lake Creek. Pumpkinseed catch per mile was above the 50th percentile for complex

riverine systems. Pumpkinseed catch per net night has decreased in Boom Lake since the panfish regulation change and increased in Rhinelander Flowage (Figure 2; bottom left pane).

Lengths of pumpkinseeds varied between 4.4 inches to 10.3 inches with a mean length of 6.5 inches (Figure 12). Mean length of pumpkinseed was in the 100th percentile for complex riverine systems. Mean length of captured pumpkinseed varied across the chain between 6.4 inches in the Rhinelander Flowage to 6.8 inches in Bass Lake**.** Proportional size distribution of pumpkinseed increased slightly since the regulation change in 2016 (Figure 4). Mean length of measured pumpkinseed has also been increasing through time (Figure 5).

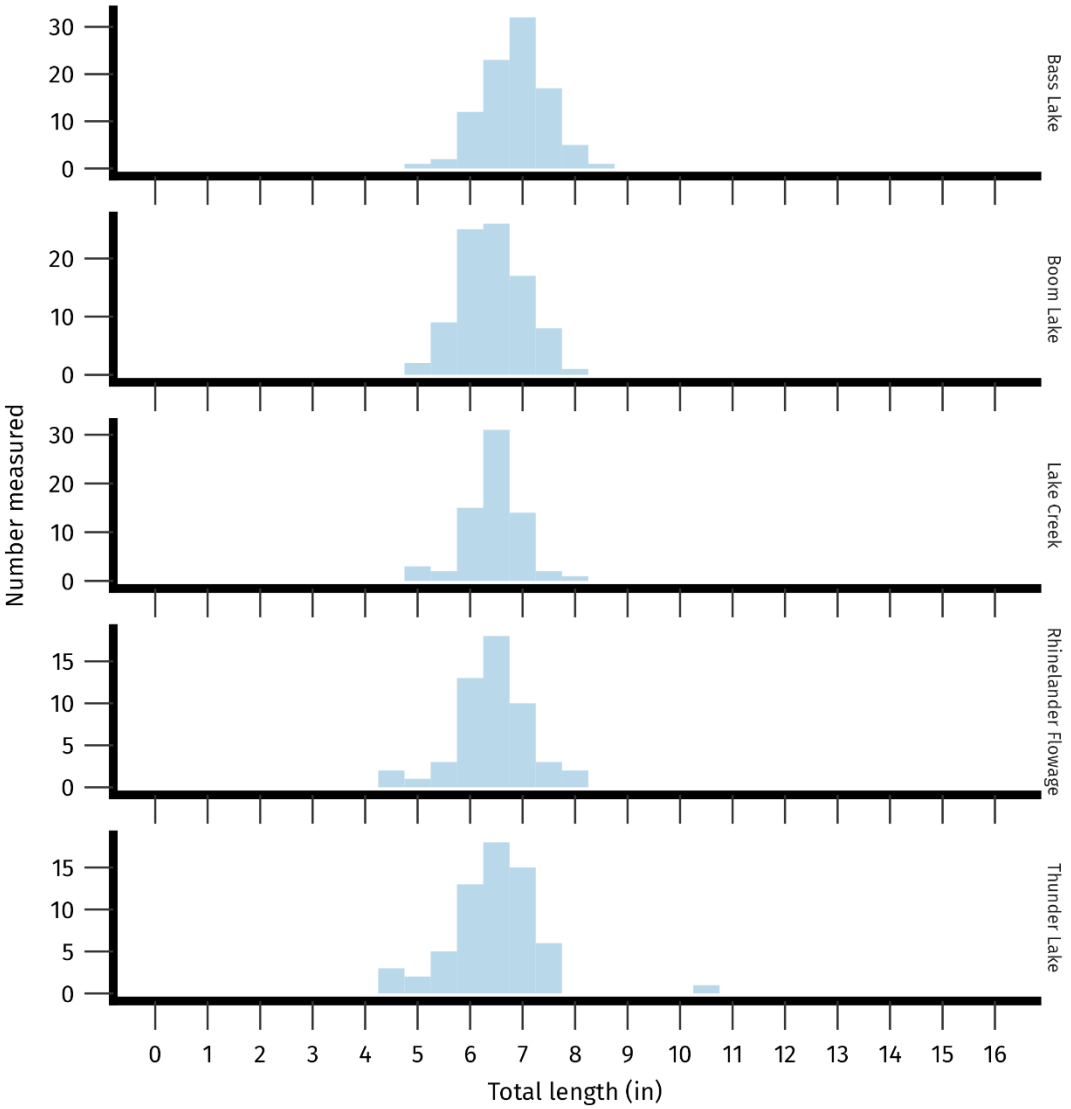

Figure 12. Length frequency of measured pumpkinseed within each lake of the Boom-Rhinelander Chain of Lakes, Oneida County, WI during the 2023 survey. Length bins are every 0.5 inch.

ROCK BASS

A total of 41 rock bass (15 electrofishing, 40 netting) were captured while surveying Boom-Rhinelander Chain of Lakes. Rock bass catch rate was 1.2 individuals per net night during netting and 0.5 individuals per mile during electrofishing. Rock bass catch per mile was below the 5th percentile for complex riverine systems. Rock bass catch rate across the chain varied between 0.0 individuals per net night in Thunder Lake to 2.6 individuals per net night in the Rhinelander Flowage.

Lengths of measured rock bass varied between 4.3 inches to 9.5 inches with a mean length of 7.2 inches (Figure 13). Mean length of rock bass was in the 95th percentile for complex riverine systems. Mean length of measured rock bass varied across the chain between 5.8 inches in Bass Lake to 8.3 inches in Lake Creek. Mean length of measured rock bass demonstrated differing trends depending on the gear type used as decreasing mean lengths were found with electrofishing but increasing mean with netting (Figure 5).

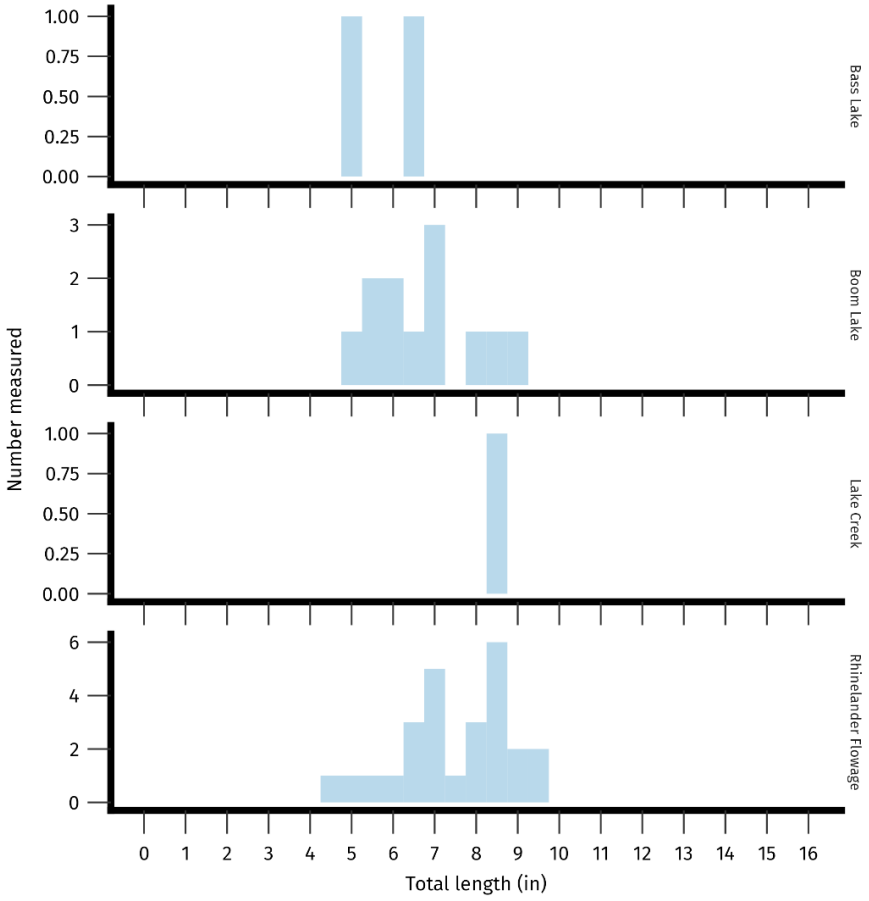

Figure 13. Length frequency of measured rock bass within each lake of the Boom-Rhinelander Chain of Lakes, Oneida County, WI during the 2023 survey. Length bins are every 0.5 inch. Thunder Lake was dropped from the figure as no rock bass were captured there. Caution should be applied when interpreting size structure as few individuals were captured.

SMALLMOUTH BASS

A total of 78 smallmouth bass (75 electrofishing, three netting) were captured while surveying the Boom-Rhinelander Chain of Lakes. Catch rate of smallmouth bass was 0.1 individuals per net night during netting and 2.8 individuals per mile during electrofishing. Smallmouth bass catch rate during electrofishing varied across the chain between 1.0 individuals per mile in Thunder Lake to 5.8 individuals per mile in Boom Lake. Smallmouth bass catch per mile across the chain was in the 59th percentile statewide and above the 25th percentile for complex riverine systems.

Smallmouth bass lengths varied between 2.3 inches to 19.9 inches with a mean length of 12.8 inches (Figure 14). Mean length of smallmouth bass was in the 90th percentile for complex riverine systems. Mean length of captured smallmouth bass varied across the chain between 12.5 inches in Boom Lake to 14.0 inches in the Rhinelander Flowage. Eighty percent of measured smallmouth bass were 11 inches or greater. Smallmouth bass proportional size distribution has decreased slightly since the regulation change in 2016 (Figure 4).

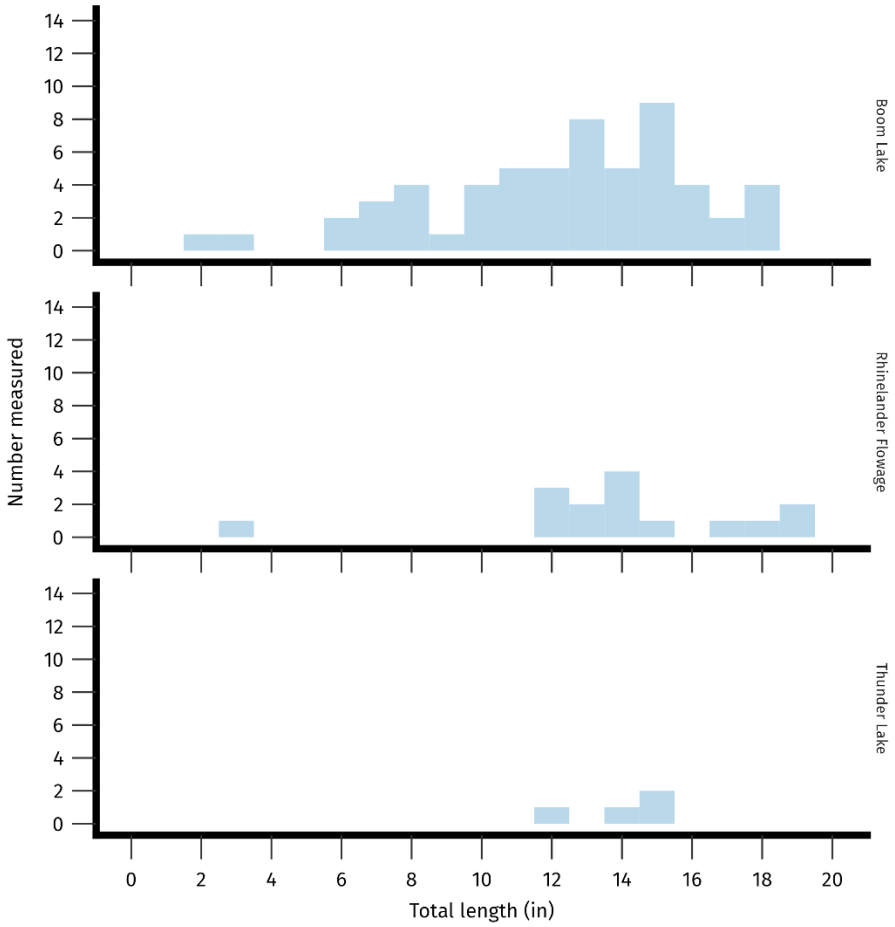

Figure 14. Length frequency of measured smallmouth bass within each lake of the Boom-Rhinelander Chain of Lakes, Oneida County, WI during the 2023 survey. Length bins are every 1.0 inch. Bass Lake and Lake Creek were dropped from the figure as no smallmouth bass were captured. Caution should be applied when interpreting size structure as few individuals were captured.

WALLEYE

A total of 198 walleye (165 electrofishing, 33 netting) were captured while surveying the Boom-Rhinelander Chain of Lakes. Catch rate was 1.0 walleye per net night during netting and 6.2 walleye per mile during electrofishing. Walleye catch rate during electrofishing varied across the chain between 2.4 individuals per mile in Thunder Lake to 8.2 individuals per mile in Boom Lake. Walleye catch per mile across the chain was in the 47th percentile statewide and catch per net night was in the 50th percentile for complex riverine systems.

Lengths of captured walleye varied between 4.5 inches to 26.5 inches with a mean length of 11.4 inches (Figure 15). Mean length of walleye was above the 50th percentile for complex riverine systems. Mean length of captured walleye varied across the chain between 10.7 inches in Boom Lake to 19.2 inches in Bass Lake. Forty-two percent of measured walleye were 15 inches or greater. Walleye proportional size distribution has decreased slightly since the regulation change in 2016 (Figure 4).

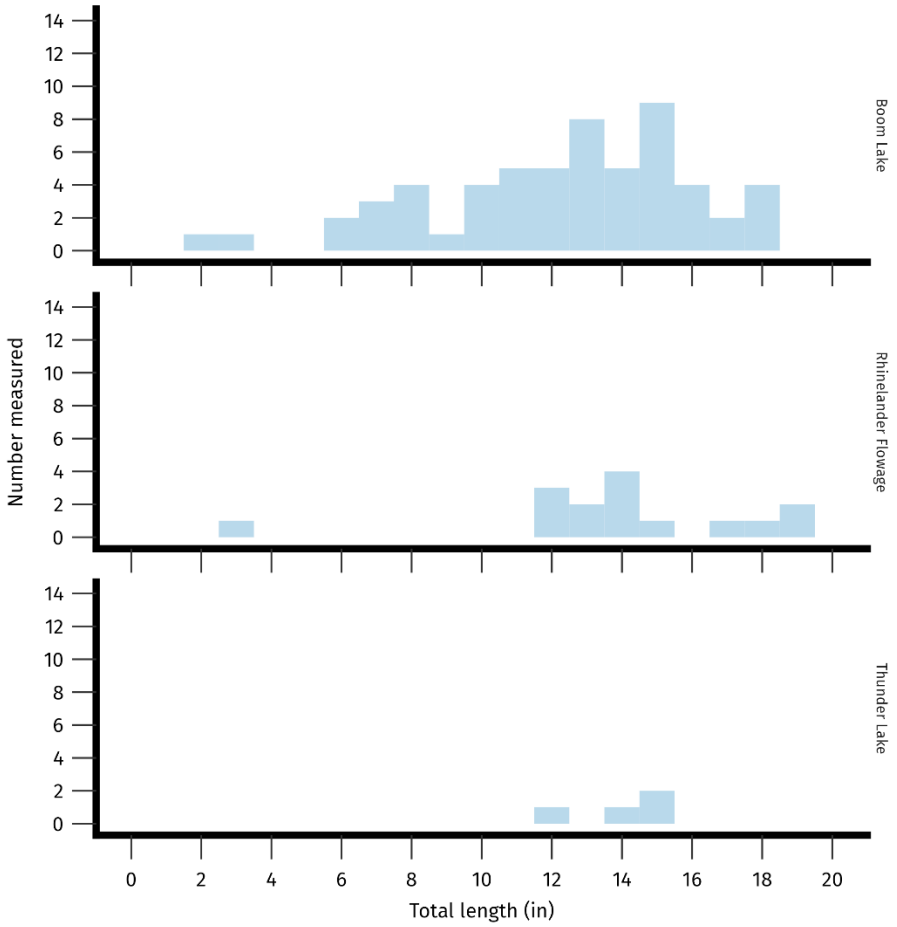

Figure 15. Length frequency of measured walleye within each lake of the Boom-Rhinelander Chain of Lakes, Oneida County, WI during the 2023 survey. Lengths bins are every 1.0 inch. Bass Lake and Lake Creek were dropped from the figure as no walleye were captured. Caution should be applied when interpreting size structure as few individuals were captured.

Thirteen age-0 and 53 age-1 walleye were captured during the 2023 FE. Catch rates of age-0 walleye varied between 0.3 individuals per mile in Boom Lake and 0.9 individuals per mile in the Rhinelander Flowage. Catch rates of age-1 walleye varied between 5.0 individuals per mile in Boom Lake and 1.8 individuals per mile in the Rhinelander Flowage. Catch rates converted to density estimates of 0.01 age-0 walleye per acre and 2.0 age-1 walleye per acre in Boom Lake and 0.02 age-0 walleye per acre and 1.6 walleye per acre in the Rhinelander Flowage.

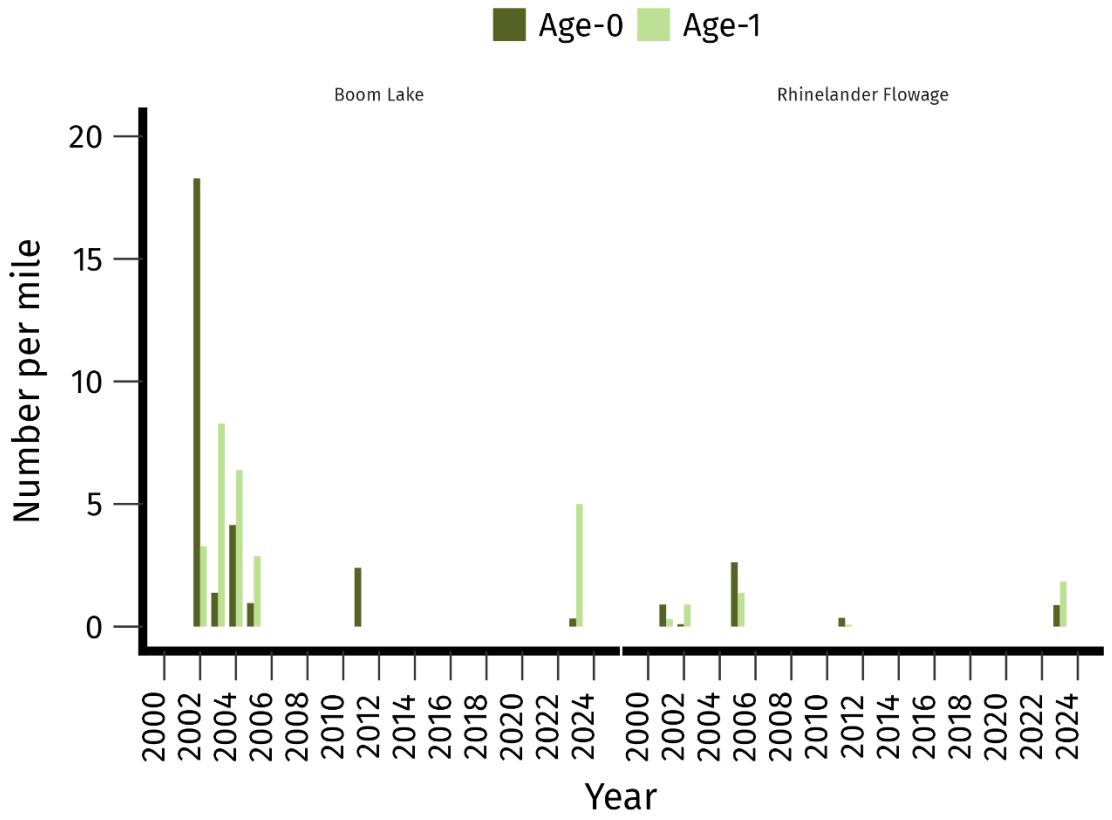

Figure 16. Number of age-0 and age-1 walleye per mile within Boom-Rhinelander Chain of Lakes Oneida County, WI. Fish ages were assigned by scales during the fall. Sampling only occurred in 2001-2005, 2010, 2011, and 2023. Sampling did not occur the other years the zero catch was reported.

YELLOW PERCH

A total of 70 yellow perch (20 electrofishing, 50 netting) were captured while surveying the Boom-Rhinelander Chain of Lakes. Catch rate of yellow perch was 1.5 individuals per net night during netting and 10.0 individuals per mile during electrofishing. Yellow perch catch per net night falls within the 54th percentile statewide and in the lower 50th percentile for complex riverine systems. Yellow perch catch rate varied across the chain between 0.8 individuals per net night in Lake Creek to 2.3 individuals per net night in Thunder Lake. Yellow perch catch rate remained relatively stable since the panfish regulation change (Figure 2; bottom right pane).

Lengths of measured yellow perch varied between 2.5 inches to 11.5 inches with a mean length of 6.8 inches throughout the Boom-Rhinelander Chain of Lakes. Mean length of yellow perch was in the 95th percentile for complex riverine systems. Mean length of captured yellow perch varied across the chain between 5.6 inches in Thunder Lake to 8.3 inches in Bass Lake. Proportional size distribution of yellow perch increased slightly since the regulation change in 2016 (Figure 4). Mean length of captured yellow perch has remained relatively stable through time (Figure 5).

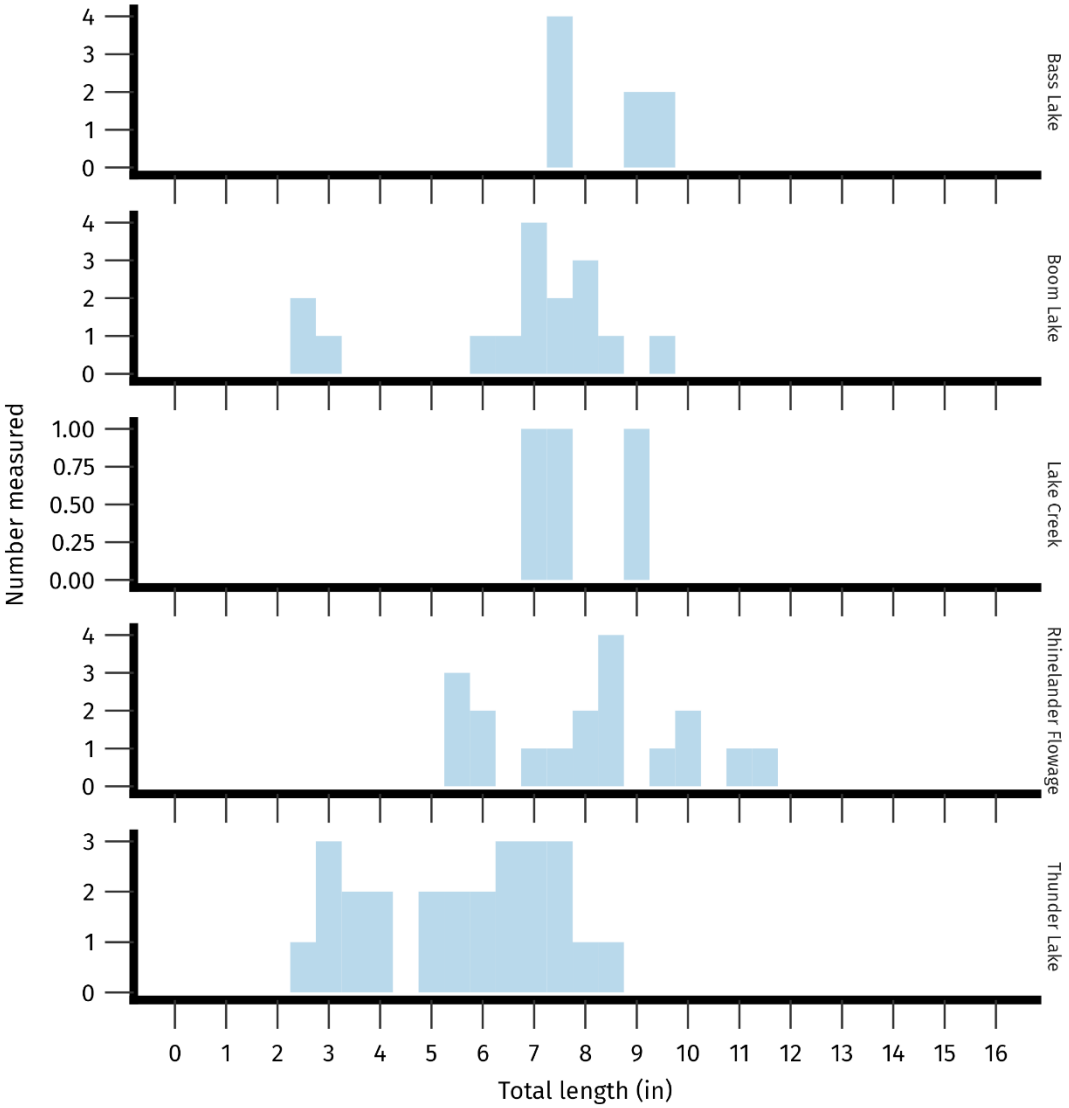

Figure 17. Length frequency of measured yellow perch within each lake of the Boom-Rhinelander Chain of Lakes, Oneida County, WI during the 2023 survey. Length bins are every 0.5 inch. Caution should be applied when interpreting size structure as few individuals were captured.

Other species

Other species encountered during the survey include black bullhead (89), bowfin (nine), burbot (one), golden shiner (16), johnny darter (four), shorthead redhorse (one), silver redhorse (one), and yellow bullhead (334).

Discussion

The Boom-Rhinelander Chain of Lakes was found to have a mixed fishery with relative abundances of desirable sized individuals for most fish species providing a variety of angling opportunities. Gamefish and panfish reproduction occur at levels currently capable of maintaining fishable populations with supplemental stocking of muskellunge. No consumption advisory exists on the Boom-Rhinelander Chain of Lakes, but fish tissue samples were collected during the study to confirm the lack of a need for consumption restrictions. Panfish appear to have responded marginally to the restricted harvest during May and June.

Effects of the experimental regulation on panfish across the Boom-Rhinelander Chain are mixed. The regulation was well supported socially as several anglers reported that the regulation change was an instantaneous success on the chain (N. Lederman, unpublished data). Biologically, the story is a bit less straightforward. Black crappie relative abundance decreased in the Rhinelander Flowage while bluegill and pumpkinseed increased since the last survey in 2011. Mean lengths of black crappie, bluegill, pumpkinseed and yellow perch increased since the 2011 survey prior to the regulation change in the Boom-Rhinelander Chain of Lakes. However, since the 2015 survey, mean lengths of black crappie and yellow perch remained relatively similar. Sample timing and water temperature are known influences on survey findings (Sullivan et al. 2019) and panfish are notorious for having variable recruitment success (Boxrucker and Irwin 2002). Thus, it is challenging to evaluate the impacts of the regulation change at the local level with a limited number of sampling points pre- and post-regulation.

Fish growth data is more sensitive than catch data in detecting response to change (Carpenter et al. 1995). Growth rates of black crappie and bluegill were quicker to stock sizes (5 inches for bluegills and 7 inches for black crappie) but slower to desirable sizes (7 inches for bluegills and 9 inches for black crappies). The quick growth to stock size may be masking potential overharvest in a more liberal panfish bag limit (e.g., 25 vs 15). Differing life history strategies and reproductive tactics of parental or cuckolder bluegill (Gross 1982) may also be influencing growth rates. Quicker growing individuals likely mature sooner and might be selected against by anglers if they are smaller. The community size structure will shift to less desirable sizes if those smaller individuals contribute more to population. However, no age data was collected prior to the regulation change allowing comparison of growth before and after the change to occur. More consistently collecting growth data and increasing the sample size of aged fish to cover the entire length structure of

targeted panfish may improve assessments in the future and assist the evaluation of angler-induced impacts and size structure shifts.

Bass relative abundance has increased in most waters of Wisconsin (Hansen et al. 2015). Increases in largemouth bass and smallmouth bass catch rates were found between 2011 and 2023 in the Boom-Rhinelander Chain of Lakes. Overall size structure of bass also decreased between 2023 and 2011 but the total length range has remained relatively similar. This could indicate increasing abundance and density dependent growth of bass. Similar to panfish, data interpretation is challenging with limited data. Growth data could help determine if density-dependent growth may be occurring. Without that growth information, the system still seems capable of supporting the abundance increase but something to monitor in the future and determine if regulation changes would be warranted.

Muskellunge reproduction is suspected to be occurring within the Boom-Rhinelander Chain of Lakes (Kubisiak 2012). Muskellunge were stocked into the Boom-Rhinelander Chain of Lakes in 2023 prior to the fall survey making it difficult to determine for certain. No tissue samples or aging structures were collected from the small muskellunge preventing confirmation of reproduction through genetic or microchemistry assessment. However, muskellunge as small as 7.7 inches were captured within the Rhinelander Flowage which drastically differs from the 11.1-inch average length from the hatchery supporting the idea of some reproduction. If muskellunge reproduction is occurring, it appears to be at a level not likely sufficient to maintain a low to moderate density fishery requiring supplemental stocking.

Muskellunge size structure decreased slightly in 2023 from the 2011 survey. A reduction in size structure may indicate more juveniles being present in the system because of improved reproduction success or increased survival of stocked individuals. However, muskellunge were not a primary target of most of this sampling resulting in a small sample size that is likely not adequate to accurately describe muskellunge (<100; Anderson and Neumann 1996). Further investigation of muskellunge size structure would warrant targeted sampling to ensure sufficient sample sizes fully representing the muskellunge population. Since the muskellunge fishery seems to still be functioning well and desirable to anglers, this effort may not be currently warranted.

Walleye reproduction within the Boom-Rhinelander Chain of Lakes was low in 2023 as it has been in previous years. The relative abundance was below the benchmark of 35 age-0 per mile standard for non-stocked lakes within Northern Wisconsin. It has been hypothesized, that the flowage may support the rest of the chain (Kubisiak 2012) but with difficulties in sampling the upper third of the Rhinelander Flowage, some individuals were likely missed reducing the relative abundance index. Despite that, survival and recruitment of young walleye may be sufficient that lower reproduction levels within the Rhinelander Flowage may support the fishery.

The Boom-Rhinelander Chain of Lakes appears to be maintaining a fishery desirable to users. The restrictive panfish regulation appears to have improved the panfish fishery and was supported by the many users. The system should continue to be managed as a mixed fishery for consumptive opportunities.

Recommendations

1. Continue stocking muskellunge at 0.25 individuals per acre to support that fishery with occasional age-0 and age-1 surveys ensuring stocking is masking the low levels of reproduction that has been documented.
2. Further restrict the panfish daily bag limit to a 10 daily bag among lakes within the chain following the sunset of the experimental regulation during the 2026 angling season to see if size structure can be further improved and growth of larger individuals increased.

Acknowledgments

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